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[Claim(s)]
[Claim 1]
In the hydraulic composite material which contains water, cement, a fine aggregate, coarse aggregate, and silica powder at least,
While containing an expansive additive further, said hydraulic composite material [the blending ratio of coal of said expansive additive] It is one to 10 mass % to the sum total of said cement and silica powder. The hydraulic composite material characterized by for the specific surface area of said silica powder being 50,000-200,000cm2/g, and for the blending ratio of coal of said silica powder being five to 15 mass % to the sum total of said cement and silica powder, and water / binder ratio being less than 15 to 25%.
[Claim 2]
While said hydraulic composite material contains further a high-range water reducing agent or a high-performance AE water-reducing agent The hydraulic composite material according to claim 1 with which the blending ratio of coal of said high-range water reducing agent or a high-performance AE water-reducing agent is characterized by being the rate of 0.5 - 4 mass % to the sum total of said cement and silica powder.
[Claim 3]
The hydraulic composite material according to claim 1 or 2 which is the lime system expansive additive with which said expansive additive used a calcium SARUHOARUMINETO system expansive additive or lime (CaO) as the principal component.
[Claim 4]
High-strength concrete which was obtained by having made any 1 clause of Claims 1-3 harden the hydraulic composite material of a description and whose compressive strength is 100Ns/mm2 or more.

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
This invention relates to a hydraulic composite material, and in detail, it relates to the hydraulic composite material with which the high-strength concrete which has the compressive strength of 100Ns/

mm2 or more is obtained while autogeneous shrinkage and drying shrinkage are controlled.
[0002]
[Description of the Prior Art]
Construction of the super-high-rise apartment building is briskly performed focusing on the Tokyo Metropolitan Government core in recent years. It is important to combine, and for the residence where amenity and salability are higher than former to be required, and to meet a buyer's needs. Development of the concrete which has hardness higher than before as one of the means to solve such technology is desired. If premised on using good aggregate for concrete with higher hardness as a production method, the cement content per unit volume of concrete of ordinary portland cement will be increased, and the method of making a water cement ratio low will be mentioned using good chemical admixture (high-performance AE water-reducing agent etc.). However, it was difficult to realize compressive strength as high as 60Ns/mm2 or more by this method. Moreover, the amount of cement paste increases and the problem of increase of the amount of autogeneous shrinkage by hydraulic operation of cement is caused. Since this autogeneous shrinkage and drying shrinkage generally known were mentioned to one of the factors which makes concrete generate a crack, development of the technique of controlling them was desired.
[0003]
The following patent documents 1 has disclosed the high-strength concrete water / whose cement ratio is 40 or less weight % and whose compressive strength a contraction reduction agent and an expansive additive are contained low-heat portland cement, a high-range water reducing agent or a high-performance AE water-reducing agent, a fine aggregate, coarse aggregate, and if needed, and is 60Ns/mm2 or more. However, the compressive strength of the obtained concrete cannot yet fill the demand for the use asked for 70-80Ns [mm2] /and the further high intensity.
[0004]
[The patent documents 1]
JP,2001-31457,A
[0005]
[Problem to be solved by the invention]
Therefore, the purpose of this invention is to offer the hydraulic composite material with which the high-strength concrete which has the compressive strength of 100Ns/mm2 or more is obtained while autogeneous shrinkage and drying shrinkage are controlled.
[0006]
[Means for solving problem]
[this invention / said hydraulic composite material] in the hydraulic composite material which contains water, cement, a fine aggregate, coarse aggregate, and silica powder at least while this invention contains an expansive additive further The blending ratio of coal of said expansive additive is one to 10 mass % to the sum total of said cement and silica powder. It is characterized by for the specific surface area of said silica powder being 50,000-200,000cm2/g, and for the blending ratio of coal of said silica powder being five to 15 mass % to the sum total of said cement and silica powder, and water / binder ratio being less than 15 to 25%.
Without according to said composition, worsening construction nature, even if water / binder ratio is low, high compressive strength can be realized and, moreover, the amount of autogeneous shrinkage and drying shrinkage can be controlled sharply.

The concrete obtained by having hardened this hydraulic composite material is high-strength concrete which has the compressive strength of 100Ns/mm2 or more.

[0007]

[Mode for carrying out the invention]

This invention is explained in more detail hereafter.

As cement used by this invention, it is JIS, for example. R The low-heat portland cement specified to 5210 is desirable. By using this cement, still less concrete of the amount of autogeneous shrinkage can be offered. In addition, when the water / binder ratio (15 to 25%) explained below are adopted, the cement content per unit volume of concrete of the hydraulic composite material in this invention becomes 750-1000kg/m3.

[0008]

What is used from the former can be used as a fine aggregate and coarse aggregate, for example, river sand, an inland sand, sea sand, crushed sand, and these mixtures are mentioned as a fine aggregate, and a river gravel, a pit gravel, a sea gravel, crushed stones, and these mixtures are mentioned as coarse aggregate.

[0009]

The silica powder used for this invention has the specific surface area of 50,000-200,000cm2/g. Although what is necessary is just to fill said specific surface area as silica powder, when especially economical efficiency is taken into consideration, silica dust grains, for example, silica fume, are desirable. By introduction of the silica powder which has said specific surface area, without worsening construction nature, even if water / binder ratio is low, high compressive strength can be realized and, moreover, the amount of autogeneous shrinkage and drying shrinkage can be controlled sharply. In addition, the water / binder ratio as used in the field of this invention are water {/ [/} (cement + silica particle)] x100. (mass %) It means.

The water / binder ratio of the hydraulic composite material of this invention are less than 15 to 25%, for example, and less than 20% of water / binder ratio can also be used for it. Without worsening construction nature as mentioned above, even if it is such low water / binder ratio, high compressive strength can be realized and, moreover, the amount of autogeneous shrinkage and drying shrinkage can be controlled sharply.

[0010]

In addition, when the specific surface area of a silica particle is the range which is 100,000-200,000cm2/g, And/or, when the blending ratio of coal of silica powder is five to 15 mass % to the sum total of cement and silica powder, since said effect about construction nature, compressive strength, the amount of autogeneous shrinkage, and drying shrinkage nature increases further, it is desirable.

[0011]

Moreover, as for the hydraulic composite material of this invention, it is desirable to contain further a high-range water reducing agent or a high-performance AE water-reducing agent. The blending ratio of coal of these aforementioned high-range water reducing agent or a high-performance AE water-reducing agent has the good rate of 0.5 - 4 mass % to the sum total of cement and silica powder. When adopting the blending ratio of coal outside this range, it is good to use, after carrying out the physical-properties examination of a setting test etc. and grasping the description of material.

Although the kind in particular of a high-range water reducing agent or high-performance AE water-reducing agent is not restricted, well-known material, such as a lignin system, a naphthalene sulfonic

acid system, a melamine system, and a polycarboxylic acid system, is mentioned, for example.
[0012]
Moreover, as for the hydraulic composite material of this invention, it is desirable to contain an expansive additive further. As for the blending ratio of coal of an expansive additive, it is good that it is one to 10 mass % to the sum total of cement and silica powder. 1 - 5 mass % is preferably good from a strong viewpoint. If the blending ratio of coal of an expansive additive exceeds 10 mass %, expanding quantity becomes large too much and hardness may fall.
What is necessary is for a hydration reaction to generate the crystal of ettringite or a calcium hydroxide, and just to have the operation which expands concrete, when it kneads with cement and water although the kind in particular of expansive additive is not restricted. Although a well-known material can be used for an expansive additive, its lime system expansive additive which used a calcium SARUHOARUMINETO system expansive additive and lime (CaO) as the principal component, for example is desirable.
[0013]
Moreover, the hydraulic composite material of this invention can also use well-known admixture, such as other air-entraining agents and a defoaming agent, for the effect of this invention in the range which does not have a bad influence if needed.
[0014]
The hydraulic composite material of this invention can be stiffened by kneading the various aforementioned material by well-known kneading equipment and a well-known method, and placing them in a mold. In addition, it is more desirable to add coarse aggregate, after the turn of kneading preceded and elaborates mortar. Moreover, it is desirable to spend the time for 3 minutes or more on kneading of mortar at least.
Thus, the obtained hardened material (high-strength concrete) is JIS. A The compressive strength specified by 1108 is set to two in 100Ns [mm2 //mm] /or more, for example, 100-150Ns.
[0015]
[Working example]
A work example explains this invention further hereafter.
According to preparation of the use material of a description, and concrete given in Table 2, water / binder ratio manufactured three kinds of concrete (hydraulic composite material), 17%, 20%, and 25%, to the following table 1. In addition, the specific surface area of silica powder is 200,000cm2/g using silica fume.
The test result of the obtained fresh concrete is shown in the following table 3. Any concrete was used as hi-performance concrete in consideration of workability.
[0016]
[Table 1]

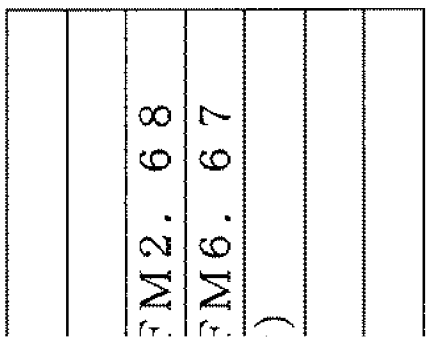


表１（使用材料）

水	水道水
セメント	低熱ポルトランドセメント（太平洋セメント社製）、密度３．２２ｇ／ｃｍ^3）
細骨材	Ｇ１：君津産山砂、表乾密度２．６２ｇ／ｃｍ^3、吸水率１．８９％、粗粒率ＦＭ
粗骨材	Ｇ１：青梅産砕石、表乾密度２．６５ｇ／ｃｍ^3、吸水率０．６３％、粗粒率ＦＭ
シリカ粉末	シリカフューム（比表面積２００，０００ｃｍ^2／ｇ、密度２．２０ｇ／ｃｍ^3）
高性能ＡＥ減水剤	ポリカルボン酸系高性能ＡＥ減水剤（ＮＭＢ社製、商品名ＳＰ８ＨＵ）
膨張材	石灰系膨張材（小野田セメント株式会社製、商品名小野田エクスパン）

表1

水	セメント	細骨	粗骨	シリ	高性	膨張

[0017]
[Table 2]

単位量 (kg／m³)						高性能AE減水剤 配合率 (結合材に対する%)
	セメント	S1君津	G1青梅	シリカフューム	膨張材	
0	847	503	853	94	0	1.60
0	720	624	853	80	0	1.30
0	576	760	853	64	0	1.40
0	847	503	853	94	30	1.75
0	720	624	853	80	30	1.40
0	576	760	853	64	30	1.50

表2（コンクリートの調合）

調合番号	水／結合材比 (%)	水
No. 1	17	160
No. 2	20	160
No. 3	25	160
No. 4	17	160
No. 5	20	160
No. 6	25	160

[0018]
[Table 3]

コンクリートの試験結果		
時間	空気量 (%)	コンクリート温度 (℃)
	1.7	21.9
	1.7	21.8
	2.2	21.9
	1.9	22.5
	1.9	22.3
	2.2	22.2

表３（フレッシュコンクリートの試験結果）

調合番号	水／結合材比（%）	フレッシュコン スランプフロー（cm）	フレッシュコン ５００ｍｍフロー時間（秒）
Ｎｏ．１	１７	６４．０	１３．０
Ｎｏ．２	２０	７０．０	５．８
Ｎｏ．３	２５	６６．０	５．７
Ｎｏ．４	１７	７０．０	８．５
Ｎｏ．５	２０	６９．０	６．３
Ｎｏ．６	２５	６７．０	６．５

[0019]
Moreover, the compressive strength of concrete is shown in the following table 4. Table 4 shows that high-strength concrete of 100Ns/mm2 or more was obtained for compressive strength in age 91 days.
[0020]
[Table 4]

	日	0	7	7	9	5	5
		.	.	.	.	.	.

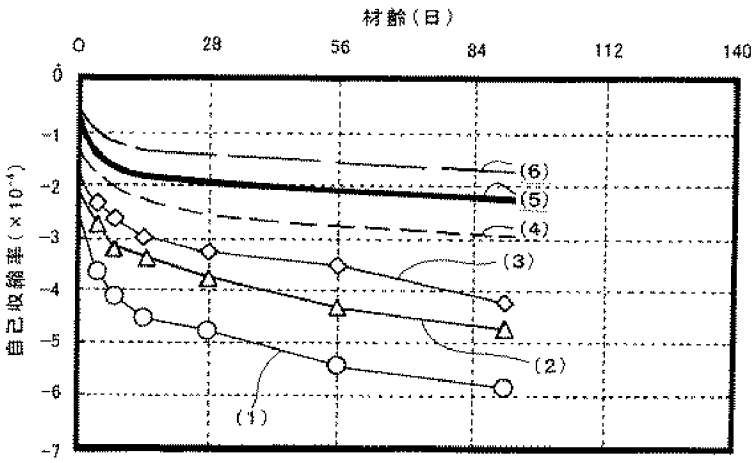
表４（圧縮強度）

調合番号	水／結合材比（%）	圧縮強度（N／mm^2）		
		７日	２８日	９１日
Ｎｏ．１	１７	９５．１	１３７．１	１６３．０
Ｎｏ．２	２０	８２．８	１２３．８	１４４．７
Ｎｏ．３	２５	６３．７	１０３．０	１２０．７
Ｎｏ．４	１７	９４．５	１３６．８	１６０．９
Ｎｏ．５	２０	８３．５	１２２．９	１４２．５
Ｎｏ．６	２５	６３．１	１０２．６	１１８．５

[0021]
Furthermore, the autogeneous shrinkage examination was done using the various aforementioned concrete. An autogeneous shrinkage examination is measured according to "the autogeneous shrinkage of cement paste, mortar, and concrete and the self-expansion test method" of Japan Concrete Institute. A result is shown in drawing 1 .
In water / binder ratio, as for 17% of concrete, and a curve 2, in drawing 1 , water / binder ratio is [curve 1 / water / binder ratio of 20% of concrete and a curve 3] 25% of concrete. However, curves 1-3 are comparative examples which do not contain an expansive additive. On the other hand, curves 4-6 are concrete containing an expansive additive.
[0022]
Drawing 1 shows that autogeneous shrinkage is remarkably controlled compared with each comparative example (curves 1-3) in which the hydraulic composite material (curves 4-6) of this invention does not contain an expansive additive.
[0023]
[Effect of the Invention]
According to this invention, while autogeneous shrinkage and drying shrinkage are controlled, the hydraulic composite material with which the high-strength concrete which has the compressive strength of 100Ns/mm2 or more is obtained is offered.
[Brief Description of the Drawings]
[Drawing 1] It is the figure showing the result of an autogeneous shrinkage examination of the various concrete manufactured in the work example.

[Brief Description of the Drawings]
[Drawing 1] It is the figure showing the result of an autogeneous shrinkage examination of the various concrete manufactured in the work example.

[Drawing 1]



[Translation done.]